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PROGRESS OF INVERTEBRATE PALÆONTOLOGY IN THE UNITED STATES FOR THE YEAR 1879.

BY DR. C. A. WHITE.

AS the operations of men's minds are not subject to the calendar, it is difficult to select any specified period of time and say just what progress in any one branch of investigation has been made within it. Therefore, in this popular review of American palæontological labors for 1879, both the distal and proximal boundaries of the year will be held somewhat loosely. That is, in giving a summary of the work done, all writings will be mentioned which have been published either originally or in their latest form, even such as appeared in the earliest days of the year; and mention will be made, not only of such works as are known to be in press at the close of the year, but also of such as are known to be in course of preparation then. These anticipatory notices have been made from information kindly communicated by the various authors who are referred to. No work, however inconspicuous, has been intentionally omitted from bibliographical notice, but even the most obscure are mentioned, leaving the question of sufficiency or insufficiency of publication to be decided by the custom of naturalists. The writer, in connection with Prof. H. Alleyne Nicholson, having published a Bibliography of North American Invertebrate Palæontology, which, with a supplement, extended to the close of the year 1878, the following account of the publications for 1879 may be made, to serve rudely as a continuation of the portion of that bibliography which relates to the United States. The reader may readily separate this bibliographical matter from the personal gossip, of which the article is largely composed.

The list of Americans now living who have at some time or other, and to a greater or less extent, contributed to the literature of invertebrate palæontology, is a rather long one, and yet the names of a large majority of them do not appear in connection with any publication of the past year. Among the active workers in this field is first to be mentioned the veteran palæontologist, Prof. James Hall, who is still engaged with his great series of works for the State of New York, upon which he has bestowed the unremitting labor of almost forty years, no one of which has been more fruitful of important results than the one just passed.

Volume v of his great series is just completed, and will, doubtless, be in the hands of scientific workers within a few weeks. It is in two parts—really two volumes—part I containing the text, and part II the plates. I regret that it has not been practicable to obtain a résumé of the contents of this volume, but it is safe to say that it is a worthy companion of any one of the series which has preceded it, the appearance of each one of which has marked an epoch in the literature of American palæontology. In 1862 Prof. Hall published in the Transactions of the Albany Institute, descriptions of a large and remarkable collection of Niagara fossils at the then newly-discovered locality near Waldron, Indiana. In 1876 he published in the documentary edition of the Twenty-eighth Report of the Regents of the University of New York, full illustrations of these fossils, but without any accompanying text. In the museum edition of the Twenty-eighth Report, just printed, Prof. Hall publishes full descriptions of all those fossils, together with the republished illustrations, embracing more than one hundred pages of text. In March of 1879, he also read before the Albany Institute, "Descriptions of New Species of Fossils from the Niagara Formation at Waldron, Indiana." This work is now published in the form of a twenty-page pamphlet, and contains descriptions of upward of forty new species and one new genus. *Ampheristocrinus*. Palæontologists will rejoice that this remarkable fauna of the Niagara period is at last fully before them. In addition to the descriptions and illustrations of the Niagara fossils, Prof. Hall also publishes in the Twenty-eighth Report just mentioned, a paper, illustrated by three large plates, entitled "Notice of some remarkable crinoidal forms from the Lower Helderberg Group." He here establishes the new genus *Camarocrinus*, of which he describes three species. A part of the remarkable fossils upon which this paper is based have been in the hands of Prof. Hall for many years; and a part of them were lately collected in Tennessee by Prof. J. M. Safford, who read a paper on them last summer at the Saratoga meeting of the American Association for the Advancement of Science. Besides these important works, Prof. Hall has a brief illustrated article on the genus *Plumulina* in the Thirtieth Report of the New York State Museum, just published, and he also read a palæontological paper at the Saratoga meeting of the American Association for the Advancement of Science. The Thirty-second

Report of the New York State Museum is in press; it contains descriptions of the Bryozoa of the Lower Helderberg group, adding fifty or sixty species to the list of those published in a former report; all being the work of Prof. Hall.

The time of Prof. R. P. Whitfield, for the past year, has been largely employed in his duties at the American Museum of Natural History at New York, and at the Troy Polytechnic Institute, but he has, meantime, continued his work upon the Palæontology of the States of Ohio and Wisconsin, the results of which are to appear in Vol. III of the former and Vol. I of the latter, respectively, both of which volumes are well advanced toward completion. At the Saratoga meeting of the American Association for the Advancement of Science, he read a paper on the Occurrence of rocks representing the Marcellus shale of New York, in Central Ohio; and published in the September number of the *American Journal of Science and Arts*, p. 22, a note on the Occurrence of *Maclurea magna* in the Barnegat (Chazy) limestone near Newburg, N. Y. These are brief papers, but they are important applications of palæontological identification of fossil forms to the elucidation of geological problems.

Besides these, he has published in the same journal for January, 1880, pages 33–42, an article on "New Forms of Fossil Crustaceans from the Upper Devonian of Ohio," in which he proposes the genera *Echinocaris* and *Palæopalæmon*, describing three new species under the former, and one under the latter genus. He has also prepared a description and figures of a large and interesting Cretaceous brachyuran crustacean, *Paramithrax* (?) *walkeri*, which will appear in connection with the palæontological work of the writer of this article, in the Annual Report for 1878 of the U. S. Geological Survey, lately in charge of Dr. Hayden. His work for the Palæontology of Ohio will be illustrated by from fourteen to eighteen plates of figures. One of these plates will be devoted to the illustration of his new forms of Devonian Crustaceans already mentioned, and one of them, in part, to the illustration of those forms upon which he bases his conclusions of the occurrence of Marcellus shale in Ohio, also before mentioned. The report will contain descriptions of new and known forms from the Lower Helderberg, Upper Helderberg and Upper Devonian; also the entire known fauna of the Maxwell limestone (=Chester and St. Louis series) and some other upper and lower

Carboniferous forms, some of which are referred to the horizon of the Burlington limestone.

His work on the Palæontology of Wisconsin is now ready for the printer and engraver, and will be issued some time during the year 1880. A total of one hundred and eighty-nine species are illustrated by twenty-six plates of figures, which fossils are referred to the following formations: Potsdam, Lower Magnesian, Trenton and Galena, Hudson River, Niagara, Guelph, Lower Helderberg and Hamilton.

He recognizes *Triplesia*, *Holopea* and *Bellerophon*, and a second species of *Palæacmæa* in the Potsdam; and also *Ellipsocephalus* and the peculiar genus *Aglaspis*, of Hall, in the same formation, thus adding materially to our knowledge of the fauna of the Potsdam period, and to the previously known range of some of the genera mentioned. The Lower Magnesian epoch he finds represented in Wisconsin by the genera *Dikellocephalus*, *Illænurus*, *Metoptoma* and *Scævogyra*, the latter being a new genus of sinistral gasteropods. He also proposes a new genus of corals, *Cystostylus*, among the fossils of the Niagara group. His palæontological recognition of the Guelph limestone in Wisconsin, is important; and he also describes new forms from that formation. Some of the species recognized as new among the Wisconsin collections have been described by Prof. Whitfield in the published annual reports of that survey, but about thirty of them are published in the forthcoming volumes for the first time. These works of Prof. Whitfield, all of which are practically finished, will become an important part of the palæontological literature of our country.

The labors of Mr. S. H. Scudder in invertebrate palæontology are confined almost wholly to fossil insects, but he has performed this work so well, and prosecuted it so vigorously, that no one seems disposed to dispute the ground with him. He is still busily engaged with his great work on the Tertiary insects of North America, which is now well advanced toward completion, and is to form Vol. XIII of the quarto series of the U. S. Geological Survey of the Territories, lately in charge of Dr. Hayden. His memoir on the Palæozoic cockroaches has just issued in quarto form from the press of the Boston Society of Natural History, in which about sixty species are enumerated and figured. A memoir in the same form and from the same press, on Early Types of

Insects, has also lately issued, and an abstract of it has appeared in the January (1880) number of the *American Journal of Science and Arts*, pages 72-74. An interesting article from his pen has also lately appeared in the Report of Progress of the Geological Survey of Canada for 1877–1878, pages 175–185, on "The Fossil Insects collected in 1877 by Mr. G. M. Dawson in the interior of British Columbia." The insects described are all referred to the Tertiary period, and represent four orders; one species being referred to the Hymenoptera, two to the Diptera, ten to the Coleoptera and four to the Hemiptera. Among the latter he proposes the new genus *Planophlebia*.

The duties of Prof. A. Hyatt at the Museum of the Boston Society of Natural History, have made such demands upon his time for the past year, as to retard the progress of his special investigations. He is still working, however, upon the Ammonites, being now specially engaged upon the *Arietidæ*, and also upon the Steinheim shells. His only published work for the past year is embraced in a paper, by the writer of this article, on "Fossils of the Jura-trias of South-eastern Idaho," in the Bulletin of the U. S. Geological Survey of the Territories, Vol. v. Prof. Hyatt there proposes and diagnoses the new Cephalopod genus *Meekoceras*.

Mr. W. H. Dall published in the Proceedings of the U. S. National Museum, Vol. 1, page 3, an interesting note on the occurrence of a Post-pliocene deposit containing recent species of marine shells in a semi-fossilized condition, at the head of a cañon near San Luis Rey, California, twelve miles from the sea and six hundred feet above tide water.

This determination of species is especially interesting and important, since it proves a considerable elevation of that coast to have taken place at a comparatively recent date. He also published in the same volume, pages 10–16, an article on "Fossil Molluscs of the Later Tertiary of California," describing six new species, and giving a table showing the known distribution of forms and the proportion of fossil and recent species respectively.

Mr. Angelo Heilprin has published in the Proceedings of the Academy of Natural Sciences at Philadelphia for 1879, three articles bearing respectively the following titles: "On some new Eocene Fossils from the Claiborne marine formation of Alabama;"

"A comparison of the Eocene Mollusca of South-eastern United States and Western Europe in relation to the determination of identical Forms," and "Stratigraphical evidence afforded by the Tertiary Fossils of the Peninsula of Maryland." The first of these papers is illustrated by a plate of figures; the other two embrace some important philosophical discussions. Mr. Heilprin has begun the preparation of a monograph of the Tertiary Fossils of Eastern North America.

George Jennings Hinde, Esq., F. G. S. of Surrey, England, published in the Quarterly Journal of the Geological Society for August, 1879, pages 352–369, an important memoir "On Conodonts from the Chazy and Cincinnati group of the Cambro-silurian, and from the Hamilton and Genesee Slate divisions of the Devonian in Canada and the United States." Palæontologists have been divided in opinion as to what class of animals these interesting remains belong to, and Mr. Hinde's important memoir still leaves us in doubt upon this point, although he has much enlarged our knowledge concerning the objects themselves.

In 1878 Mr. U. P. James began, at Cincinnati, the publication of *The Palæontologist*, for which he is thus far the only writer. Four numbers have been printed, aggregating thirty-two pages octavo, two numbers of which have appeared in 1879. In these two numbers Mr. James describes twenty-one new forms of Lower Silurian fossils, and proposes two new fucoid genera, *Saccophycus* and *Lockeia*.

Mr. Victor W. Lyon described three new forms of *Calceola* from the Upper Silurian rocks of Kentucky, in the Proceedings of the Academy of Natural Sciences at Philadelphia for 1879, pages 43–46.

Mr. S. A. Miller has, during the past year, published in pamphlet form, of thirty-five pages, a revision of his "Catalogue of Fossils found in the Hudson River, Utica Slate and Trenton groups, as exposed in the south-east part of Indiana, south-west part of Ohio and northern part of Kentucky," which originally appeared in the Tenth Annual Report of the Geological Survey of Indiana. In the April number of the Journal of the Cincinnati Society of Natural History, pages 31–42, he has "Remarks upon the Kaskaskia group, and descriptions of new species of Fossils from Pulaska county, Kentucky;" the new forms being illustrated, with others, upon the two plates which that number contains. In the July number of the same journal, pages 104--118, Mr. Miller has "Descriptions of twelve new Fossil species, and remarks upon others." The species are from the Hudson River, Niagara and Upper Helderberg groups, all being echinoderms except one fucoid, and all are illustrated upon the two plates which accompany the number.

Prof. James M. Safford read a paper at the Saratoga meeting of the American Association for the Advancement of Science, on some remarkable Crinoids from Tennessee, which form the subject, in part, of the article by Prof. Hall in the lately published edition of the Twenty-eighth Regent's Report, and which has already been mentioned.

Mr. E. O. Ulrich has, in the April number of the Journal of the Cincinnati Society of Natural History, an illustrated article entitled "New genera and species of Fossils from the Lower Silurian about Cincinnati. He describes thirty-two species, and proposes three new genera, *Lepidolites*, *Ropalonaria* and *Crateripora*. In the October, 1879, number of that Journal, pages 119–134, he has two articles entitled, respectively, "Description of a new genus and some new species of Bryozoans from the Cincinnati Group;" and "Description of a Trilobite from the Niagara Group of Indiana," both being illustrated. He has also lately personally published a thirty-two page pamphlet, "Catalogue of Fossils occurring in the Cincinnati Group of Ohio, Indiana and Kentucky."

Lieut. A. W. Vogdes, in "Notes on the Geology of Catoosa county, Georgia," in the December number (1879) of the *American Journal of Science and Arts*, page 477, names and briefly characterizes *Calymene rostrata*, a new Upper Silurian trilobite.

Messrs. Charles Wachsmuth and Frank Springer have published, in the last number for 1879 of the Proceedings of the Academy of Natural Sciences of Philadelphia, a "Revision of the Palæocrinoidæ. Part I. The families Ichthyocrinidæ and Cyathocrinidæ." Those who have done original work with the palæozoic crinoids, or attempted a critical study of them, can fully appreciate the importance of the work which has been undertaken by these authors. The portion now published is the first of a proposed series, and contains about one hundred and fifty pages and three plates of illustrations. It contains a discussion of the general subject and of the questions pertaining to the two families now considered; a rearrangement of the genera and sub-genera under each, and lists of all the known species of each genus with their synonymy.

Mr. C. D. Walcott, in four pages printed in advance of the Thirty-second Annual Report of the New York State Museum of Natural History, publishes "Descriptions of new species of Fossils from the Calciferous formation," embracing five new forms. He has also published a pamphlet of thirty-eight pages and two plates, in advance of Vol. x, Transactions of the Albany Institute, with the triple title, "The Utica Slate and Related Formations; Fossils of the Utica Slate; and Metamorphosis of *Triarthrus becki*." In these papers Mr. Walcott presents some interesting discussions, makes known important facts bearing upon the subjects indicated by the titles, and proposes the genera *Cyathophycus* and *Discophycus*. The Thirty-first Annual Report of the New York State Museum has lately been issued, which contains the final publication of Mr. Walcott's papers, "Notes on some sections of Trilobites from the Trenton limestone;" "Note upon the Eggs of the Trilobite," and "Descriptions of new species of Fossils from the Chazy and Trenton limestone." Mr. Walcott has also much important material in hand, which will, when published, add largely to our knowledge of the anatomy of the Trilobite.

In the January (1879) number of the Journal of the Cincinnati Society of Natural History, Prof. A. G. Wetherby has an article entitled, "Description of a new family and genus of Lower Silurean Crustacea," which is illustrated by eight figures on plate 7 in the April number of the same journal. The proposed new family and genus (*Enoploura*) are founded on the *Anomalocystites* (*Atelocystites*) *balanoides* of Meek, which Prof. Wetherby removes from the Cystidians, where it was placed by Meek, to the Crustacea. He also publishes in the April number of that journal, some interesting remarks upon the genus *Pterotocrinus* Lyon and Cassidy, with illustrations. He thinks the genus more nearly allied to *Eucalyptocrinus* than any other, and not nearly related to *Dichocrinus*, as has been formerly supposed by some palæontologists. In the October number, pages 134–140, Prof. Wetherby has "Descriptions of new species of Crinoids from the Kaskaskia group of the Sub-carboniferous," with one plate of illustrations. He has also in press, a revision of certain species of Crinoids which have been referred to the genus *Zeacrinus*.

Professor A. Winchell has an investigation of the Cephalopods of Tennessee nearly completed, and is also pursuing his investigations of the Stromatoporidæ.

The writer of this article has published in Vol. v, of the Bulletin of the United States Geological Survey of the Territories, the three following "Palæontological Papers:" No. 9—"Fossils of the Jura-trias of South-eastern Idaho," pages 105–118; No. 10—"Conditions of Preservation of Invertebrate Fossils," pages 130–142, and No. 11—"Remarks upon certain Carboniferous Fossils from Colorado, Arizona, Idaho, Utah and Wyoming, and certain Cretaceous Corals from Colorado, together with descriptions of new Forms," pages 209–221. He has also in the same volume, pages 143–152, in connection with Prof. H. Alleyne Nicholson, a supplement to the Bibliography of North American Invertebrate Palæontology. The March number of the *American Journal of Science and Arts* also contains an article from his pen entitled, "Remarks on the Jura-trias of Western North America."

The most important of these papers is No. 9, relating to the discovery of Triassic types in the region indicated, the epoch of the Muschelkalk of Europe being fully recognized. It is in this paper that the new genus *Meekoceras* of Hyatt is diagnosed.

The writer has also in press a series of Contributions to Invertebrate Palæontology, seven in number, illustrated by thirty-eight lithograph plates. The first portion with ten plates has just been published separately, and is to appear in the Annual Report of the U. S. Geological Survey of the Territories for 1877, and the remainder in that for 1878. The fossils described and illustrated are from the following formations: Carboniferous, Triassic, Jurassic, Cretaceous, Laramie and Tertiary. A large proportion of these species have been described by the writer in different publications of the surveys, formerly in charge of Dr. Hayden and Prof. Powell respectively; a part are therein described for the first time, and the remainder are species that have, by different authors, been described in various publications, but not illustrated. These descriptions last referred to are mostly by the late Mr. F. B. Meek and Dr. B. F. Sherward. It has been the aim of the writer to illustrate all the species described by these two authors as well as others, so far as practicable; and when the volumes in question appear, there will remain comparatively few described species from strata of the western half of our country that will not have been illustrated.

Besides the foregoing, the writer has also in press, for the Proceedings of the U. S. National Museum the following articles and notes: "Descriptions of new species of Carboniferous Invertebrate Fossils;" "Descriptions of new species of Cretaceous Fossils from Kansas and Texas;" "Note on the occurrence of *Productus giganteus* Martin, in California," and "Note on *Criocardium* and *Ethmocardium*." The three first-named papers are illustrated by seven plates of figures. In the first paper is proposed the new Crinoid genus *Lecythiocrinus*, from the Upper Coal measures of Kansas. In the second, two species are described from the Dakota beds of Kansas, collected by the late Prof. Mudge, adding to our knowledge of the fauna there, which links the lower American Cretaceous with the upper much more closely than was formerly supposed. The discovery of that huge brachiopod, *Productus giganteus*, in the western part of the continent, where it has hitherto been unknown within its limits, is an interesting fact. The sub-genus *Ethmocardium* is proposed in the last-named paper for a *Cardium* (*C. speciosum* Meek and Hayden), which is without spinules, and has rows of cleanly-cut holes through the entire thickness of the test, which occupy the spaces between the ribs of the middle portion of the shell.

Among the many important facts brought out in the "Contributions," it is there shown that many of the types by which the living North American land and fresh-water molluscan fauna is characterized, have descended to us almost entirely unchanged from the Laramie period and, in some cases at least, from the still earlier Cretaceous epochs. Even some of the sub-divisions of genera, made by different authors, and which some others have been slow to accept, as insufficiently founded, are found to have become established in those early times, and to have maintained their slightly differentiated status intact during the intervening epochs. It also appears that the nearest relatives, and doubtless the lineal descendants of the Laramie and Tertiary fresh-water and land mollusca are found living in the fluvatile waters and drainage areas of the Mexican gulf and Arctic ocean, and not upon the Pacific slope. Some exceedingly interesting zoölogical questions are thus suggested.

No investigation of living forms has a more direct bearing upon invertebrate palæontology than that of the Brachiopoda. For this reason mention should be made here of a memoir by Prof. W. K. Brooks, on the "Development of *Lingula* and the systematic position of the Brachiopods," published in Scientific Results for 1878, Chesapeake Zoölogical Laboratory, Johns Hopkins University, Baltimore, 1879. Prof. Brooks opposes the views so long and ably advocated by Prof. Morse, that the Brachiopoda are specialized worms, and presents his reasons for regarding them as more nearly related to the Polyzoans.

The foregoing notes, so far as is known, embrace all the publications that come within the scope of this article. There are, doubtless, other works in progress whose authors are waiting suitable opportunity to pursue their investigations. Prof. A. R. Grote has some uncompleted and unpublished notes on a new form of the remarkable crustacean genus *Eusarcus* Grote and Pitt, in the Waterlime group of Western New York. Prof. Verrill has also in hand the few fossils that were dredged from the submerged Tertiary beds off the north-eastern coast, but nothing has been published concerning the fauna of this Tertiary Atlantis since his article of last year in the *American Journal of Science and Arts.*

It has often been a subject of remark during the past few years that invertebrate palæontology was receiving comparatively little attention in the United States, but the foregoing makes a very satisfactory showing for the past year. The excellent character also of much of the work that is being done by the younger palæontologists promises well for the future.

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A REVIEW OF THE MODERN DOCTRINE OF EVOLUTION.—CONCLUDED.[1]

BY E. D. COPE.

III. Metaphysics of Evolution.

I ENTER here upon a wide field, over which I can only skim on an occasion like the present. The subject has been already introduced by reference to consciousness as modifying

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[1] A lecture delivered before the California Academy of Science, Oct. 27, 1879.